

OMPS SO₂ and NO₂ Products Status and Outlook

Kai Yang – UMCP

Simon Carn – MTU

SNPP/OMPS SO₂ and NO₂ Products

Standard Products:

SO₂

- Boundary layer vertical SO₂ column
- Height-resolved vertical SO₂ column

NO₂

- Vertical tropospheric and stratospheric NO₂ Columns

SO_2 Products

Near-Real-Time (NRT) Products for Volcanic Plume Monitoring

- Lower Stratospheric (STL), Mid Tropospheric (TRM), and Lower Tropospheric (TRL) SO_2 vertical columns and Aerosol Index
- Linear-Fit (LF) algorithm is used to generate the NRT products.
- NOAA implements LF algorithm for operational processing OMPS data.

ATBD Delivery

- Algorithm Theoretical Basis Documents (ATBD) based on published papers
- Complete ATBD in 6 to 9 months

Algorithms for Standard Products

Direct Vertical Column Fitting (DVCF) Algorithm

$$\ln I_m(\lambda) - \ln I_{\text{TOA}}(\lambda) = V \int_0^{\infty} \frac{\partial \ln I_{\text{TOA}}}{\partial \tau_z} S_z \sigma(\lambda) dz - \sum_i \xi_i \sigma(\lambda, T_i) + (\Delta R + c_1(\lambda - \lambda_0)) \frac{\partial \ln I_{\text{TOA}}}{\partial R}$$

- λ : wavelength : V
- I_m : measured radiance : S_z
- I_{TOA} : radiative transfer simulation : ξ_i
- σ : trace gas absorption cross sections : c_1
- R : Surface reflectivity or cloud fraction :
- SO_2 or NO_2 vertical column : V
- SO_2 or NO_2 Shape factor : S_z
- Other absorber slant column : ξ_i
- Aerosol Index : c_1
- Altitude-resolved Air Mass Factor :

Processing Steps

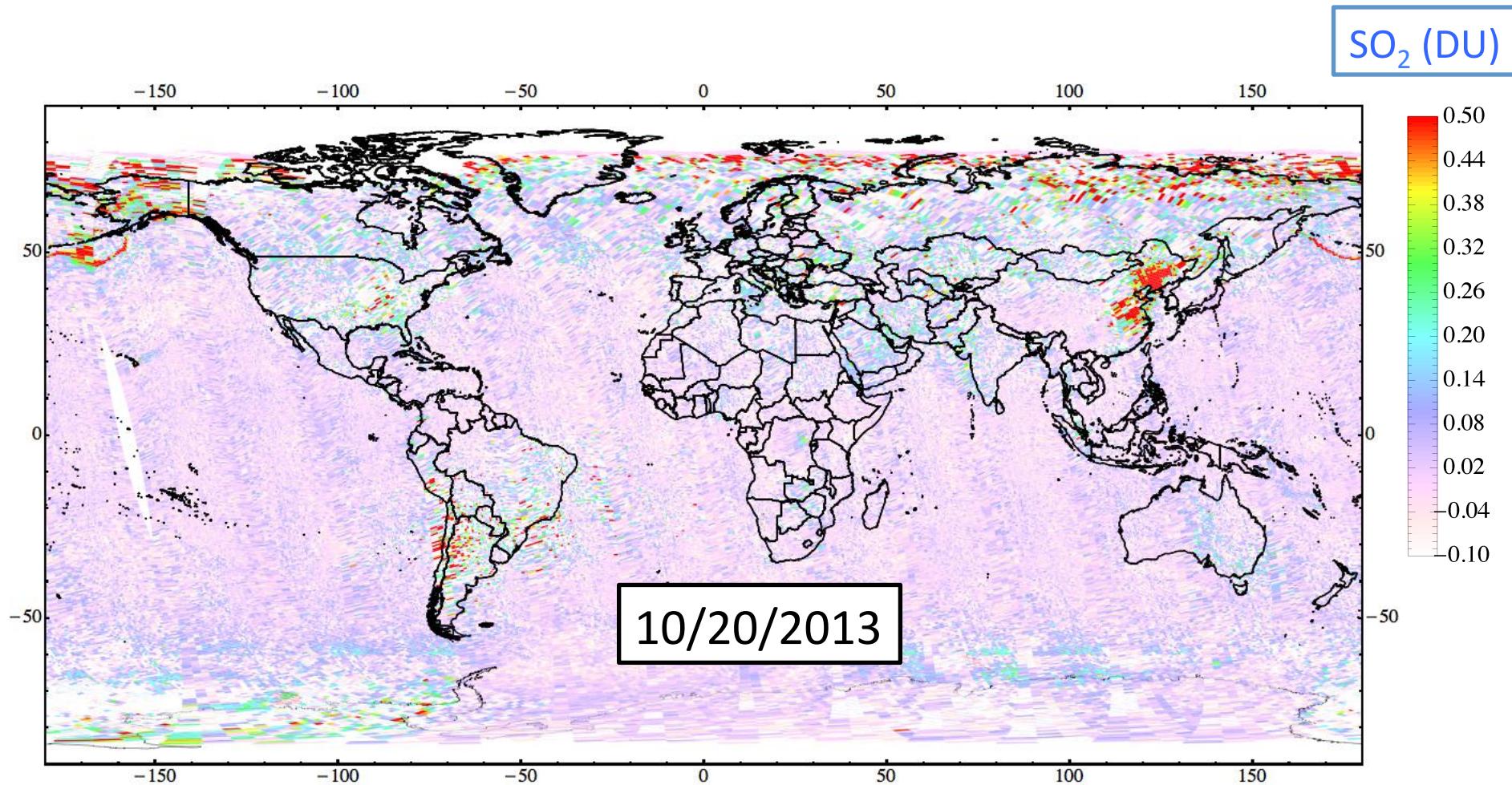
1. NO_2 and MLER parameters

- NO_2 Retrieval: 345 – 378 nm
- NO_2 : 345 – 378 nm, reflectivity/cloud fraction, pressures, aerosol index: 350 – 378 nm
- Orbit-based strat-trop separation

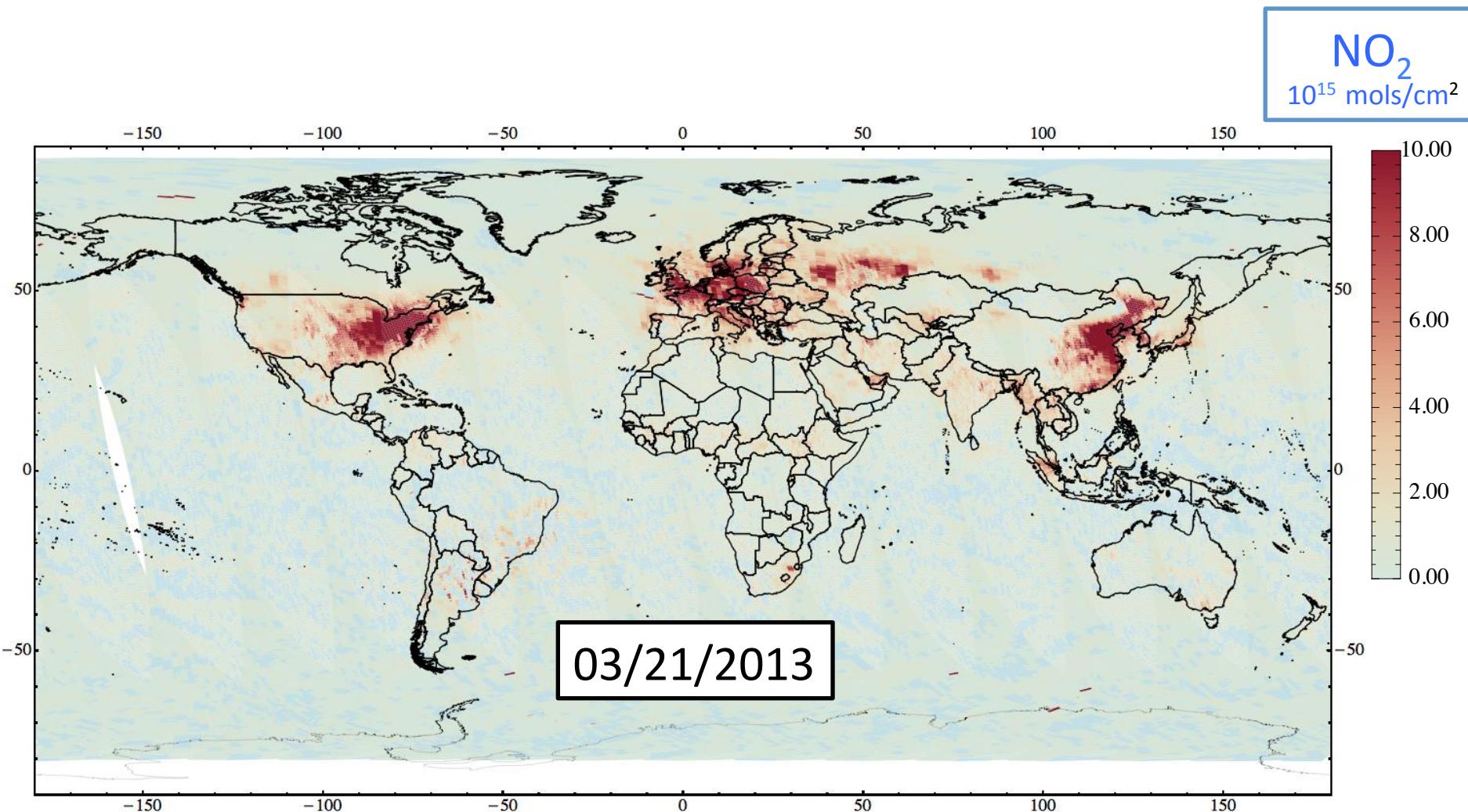
2. O_3 and SO_2

- SO_2 Retrieval: 308 – 360 nm
- SO_2/O_3 : 308 – 333 nm , reflectivity/cloud fraction, aerosol index : 333 – 360 nm

Product Sample: Boundary Layer SO₂



Product Sample: Tropospheric NO₂



Outlook

- OMPS provides unprecedented measurement sensitivity to boundary layer SO_2 , with minimal bias and artifacts.
- OMPS provides high-quality measurements of tropospheric NO_2 , with sensitivity similar to those of Aura/OMI.
- Algorithm advances facilitate these OMPS achievements, enabling continuity of Aura/OMI data records with OMPS data.

Maintaining Product Consistency

- The quality of SO_2 and NO_2 products depends on the OMPS L1B data
- Soft calibration necessary for both SO_2 and NO_2 , and highly effective schemes developed.

Recent Progress

- New total O₃ retrieval approach to improve product quality and to eliminate discontinuity
- Improved Ring corrections
- New SO₂ and NO₂ climatology profiles from GEOS-Chem with updated emissions